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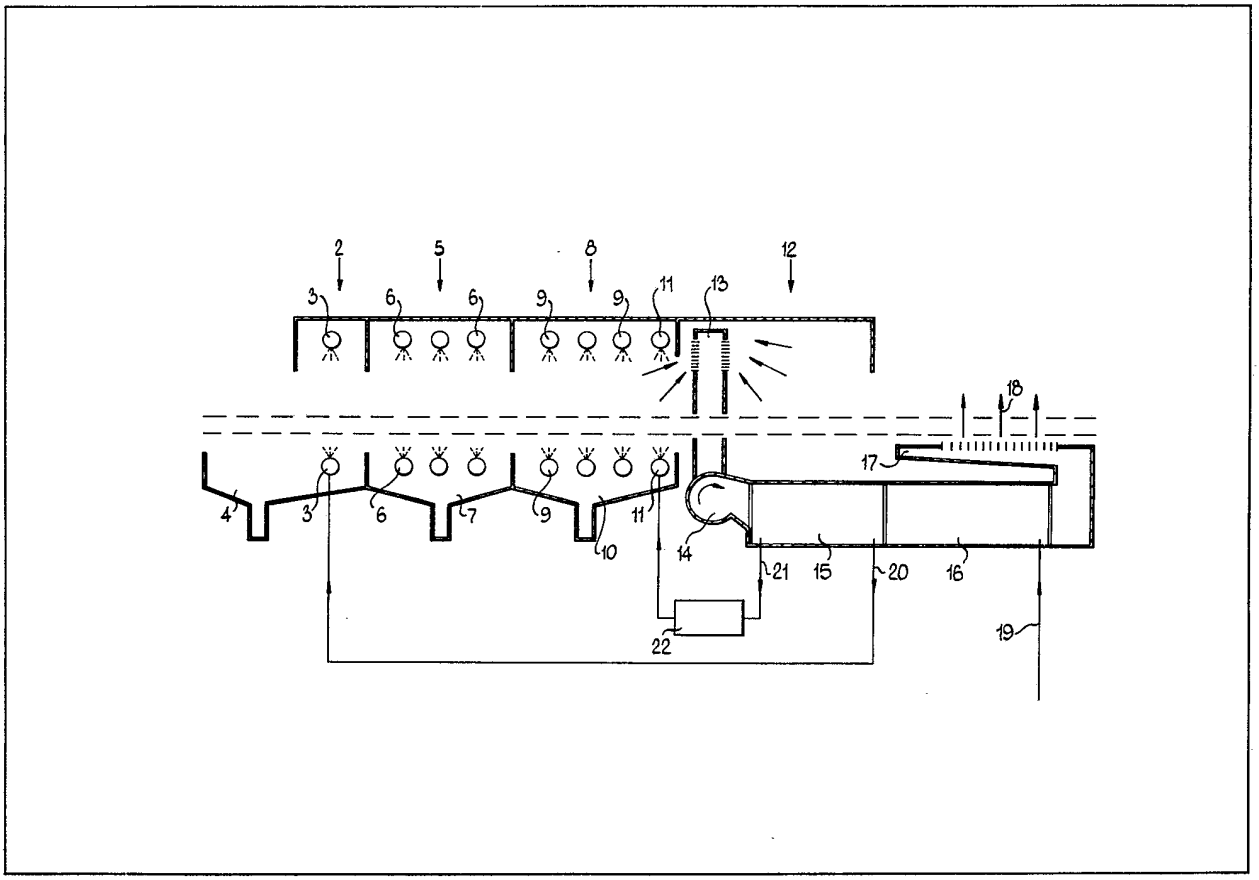
(54) **Dishwashing machine**

(57) In a commercial dishwashing machine having a conveyor for conveying the dishes to be washed there is provided along the conveyor different zones 2, 5, 8, 12 for washing, rinsing and drying the dishes. In order to improve the working environment at the discharge end of the machine and to cool the dishes leaving the machine, hot and humid air is withdrawn from the interior of the machine e.g. by suction fan 14. This air is refrigerated in a two-stage heat exchanger 15, 16 and thus dehumidified. It is exhausted through outlet 17 at the exit end of the machine to cool the dishes and the ambient air. Cold water supplied to the heat exchanger via inlet 19 is heated and used for spraying the dishes in different zones of the machine. Water exiting via line 21 may be heated by an electric heater 22.



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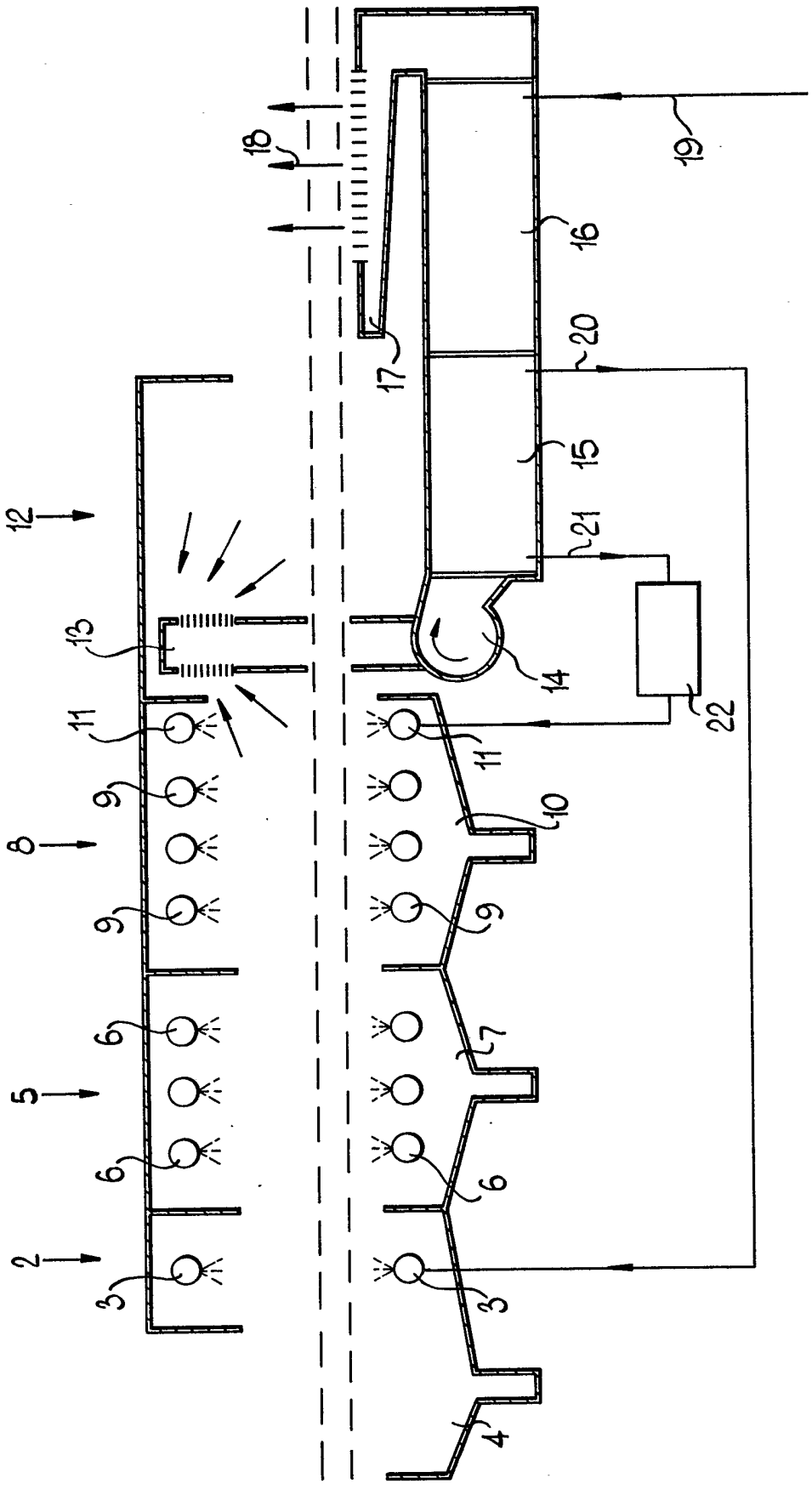

SPECIFICATION

Dishwashing machine

This invention relates to a dishwashing machine of the type in which dishes to be washed enter the machine at one end, are conveyed through the tunnel like machine and are discharged at the opposite end thereof, and more specifically to a method for saving energy and for improving the environment at the discharge end of the machine by making it possible to refrigerate the dishes heated during the passage through the machine and to reduce to pleasant levels both the temperature and the air humidity at the discharge end of the machine.

In conventional dishwashers where the dishes are conveyed through the different dishing zones of the machine and through the drying zone the dishes are leaving the machine at a high temperature in the order of 60°C. Further, there often takes place a flow of rather big volumes of heated air from the drying zone of the machine. The hot dishes and the hot air discharge as well implies that the working environment at the discharge end of the machine are oppressive to those persons who are manually removing the dishes from the conveyor. Further, at short interruptions of the operation of the machine large volumes of steam may flow from the interior of the machine into the room in which the machine is located. In an attempt to reduce these drawbacks there has been proposed to remove from the drying zone some of the hot and humid air and to have it flow through a heat-exchanger for reducing its temperature to a rather low level and then to exhaust it from the machine at this temperature via a ventilation duct, usually of a rather large cross sectional area. Even if a certain flow of air has been sucked from the drying zone there remain the problems caused by the hot dishes leaving the dishwasher and practical problems caused by the ventilation duct.

Therefore, this invention has for its object to achieve a method for eliminating these drawbacks so that the dishes can be removed by unprotected hands from the conveyor and the air temperature at the discharge end of the machine be reduced to a level convenient to the persons working there and the ventilation duct be omitted.

According to the invention these objects are achieved if the method incorporating the steeps of feeding the dishes along a conveyor in the dishwasher and spraying them with one or more liquids and then drying them in a heated zone, is characteristed in that hot and humid air is withdrawn from the interior of the machine and/or the drying zone, that the temperature of this air is reduced to a value below room temperature the heat energy thereof being transferred to the liquid and that the refrigerated air is exhausted in the vicinity of the hot dishes leaving the machine.

The invention also relates to an apparatus for carrying the method mentioned above into effect, said apparatus comprising a conveyor having spray units along it and a drying zone through which the conveyor is extending and being characterised by at least on suction device at a location at the conveyor where high values of temperature and humidity exist, that the suction device has flow connection with a heatexchanger having one inlet for cold water and at least one outlet for heated water the air outlet of said heatexchanger being provided for exhausting refrigerated air for cooling the area surrounding the discharge end of the conveyor and the dishes thereon.

The invention is now to be described more in detail below, reference is being made to the accompanying drawing showing a cross sectional view of a dishwashing machine of the type indicated above.

A conventional dishwashing machine of the type here referred to is provided with a conveyor 1 indicated on the drawing in double broken lines. This conveyor is designed for conveying the dishes and extends substantially in the horizontal direction through the entire machine. At the entrance end of the machine there is provided a pre-spraying zone 2 having one or more spray nozzles 3 for directing jets of rather cool, eg 25-30°C, water against the dishes being conveyed through the pre-spraying zone so that food-rests and the like are partially removed from the dishes. When used, the pre-spraying water is collected in a collecting vessel 4 and is then discharged therefrom, eg to a drainage.

In the moving direction of the conveyor after the pre-spraying zone 2 there is provided a washing zone 5 which may be separated from the pre-spraying zone 2 by means of a partion wall allowing passage of the dishes. In the washing zone 5 there are provided a number of spray nozzles 6 which preferably are located above the conveyor 1 and below it aswell said spray nozzles directing jets of heated washing liquid against the dishes being conveyed through the washing zone. The washing liquid preferably consists of water at 60°C having added thereto a suitable detergent. When used the washing solution sprayed from the nozzles 6 is collected in a collecting vessel 7 having a heating device for heating the washing solution to the intended temperature. From the collecting vessel 7 the washing solution is then, after filtering, recirculated to the nozzles 6.

In the moving direction of the conveyor 1 after the washing zone 5 there is provided a post-washing zone 8 having in the same manner as the washing zone 5 a number of nozzles 9 for directing jets of heated washing solution against the dishes being conveyed through the postwashing zone 8. The washing solution in this zone preferably has a temperature higher than the temperature in the washing zone 5 said temperature preferably has a value in the order of 70°C. As is the case in the washing zone 5 the washing solution is collected in a collecting vessel. Further, the post-washing zone is separated from the other zones of the machine by means of partion walls allowing passage of the dishes from one zone to another. Fially, there is provided in the post-washing zone nozzles 11 for directing jets of heated rinsing water against the dishes so that under influence of these jets detergent possible remaining on the dishes is removed. A preferred temperature of this water may be 80°C. In

the shown embodiment the rinsing water is sprayed from the nozzles 11 is collected in the collecting vessel 10 after use.

After the post- washing zone 8 there is a conventional dishwashing machine of the type here refered to provided a drying zone 12 where heated air is cirkulated about the washed and rinsed dishes. The average temperature in this zone is preferably kept at approx, 80°C so that the evaporisation of water from the dishes is good provided the relative humidity of the air in the drying zone is kept at a value not to high. In a conventional dishwasher this is achieved by partially withdrawing the air and possibly after reheating it, recirkulating it together with fresh, heated air. The remaining portion of the air leaving the drying zone is exhausted and is not used again. The dried dishes having a temperature in the order of 60°C are conveyed from the drying zone to the exit of the dishwashing machine where they are removed manually. Naturally it is not advisable to handle dishes of such high temperature with unprotected hands and further it is impossible to prevent that a certain portion of the heated air in the drying zone is leaking out to the exterior of the machine which implies that the temperature at the exit end of the machine will be oppressive high and that protective glowes should be used be the persons operating the machine.

Of course the dishwashing machine can be divided to zones in a way different from that described above. Thus, the machine can have a pre-spraying zone in which pre-spraying is carried out with non-recirculating water of 30°C, then a zone for pre-washing with recirculating water of 40°C, a zone for so called chemical washing in which zone the main washing is carried out with recirculating water of 60°C having added thereto a detergent. Then there could be a zone for post-washing and rinsing said post-washing is carried out with recirculating water of approx. 70°C. The final rinsing is carried out with non-recirculating water of approx. 85°C. After this zone there is provided the drying zone and the zone for discharging and collecting the dishes. Of importance to the invention are not the details of the way in which the machine is divided to zones but only the fact that there exists at least at certain locations inside the machine hot and humid air that might leak out from the machine and increase the temperature to a level unplesant to the persons operating the machine.

According to the invention there is provided in the drying zone of the dishwashing machine a suction device 13 located in such a manner that it draws out heated air with high moisture content both from the drying zone proper and from the adjacent post-washing and rinsing zone 8. This location of the suction device 13 implies that the flow of air will occur approximately in he way indicated by the arrows on the drawing. Therefor, the air drawn in by the suction device has a high temperature and a high relativ humidity in practice often amounting to 80%. The suction device 13 is connected to a fan 14 for propelling the hot and humid flow of air through a heat-exchanger having a first step 15 and a second step 16. From the second step 16 of the heatexchanger there is provided a duct connected to an air exhaust device 17 from which the refrigerated and thus dehumidified air is exhausted as is indicated by the arrows 18. The air exhaust device is preferably located below the conveyor 1 so that the cold air will flow about and cool the dishes and at the same time decrease the ambient temperature at the exit end of the machine. The heat exchanger 15, 16 further has an inlet 19 connected to the water mains from which cold water is supplied, usually at a temperature of 8-10°C. The heatexchanger has in the region between the first and second steps an outlet 20 for heated water. A certain portion of the water supplied via the inlet 19 is discharged from the outlet 20 at an elevated temperature in the order of 25-30°C. At the air inlet end of the first step 15 of the heatexchanger there is provided a second outlet 21 for heated water. From this outlet there is discharged the remaining portion of the water supplied to the heatexchanger via the inlet 19. This water preferably has a temperature in the order of 50-60°C and the volume flow thereof preferably amounts to 50-70% of the volume flow of the water supplied via the inlet 19. The outlet 21 is connected to a heating device, eg of electric type, shown on the drawing at 22. The outlet of the heating device 22 is connected to the nozzles 11 for delivering rinsing water having a temperature of approx. 85°C. Thus, the heating device 22 only has to increase the temperature by some 30°C.

As mentioned above the heatexchanger 15, 16 has an outlet 20 for heated water and this outlet is connected to the nozzles 3 in the pre-spraying zone of the machine. Thus, all the heat necessary for heating the water supplied to the nozzles 3 is recovered at a low temperature from the flow of air drawn in by the suction device 13 this flow of air having its high energy content due to evaporation of the washing solution and the rinsing water and due to the feeding of heated air to the drying zone. This means that there is achieved a very good degree of energy recovery as the water flow from the nozzles 3 is of high rate and there would be needed a considerable effect for heating to the required 25-30°C, this flow of water supplied at 8-10°C. In practice a heating effect of approx. 35 kW has been measured in the second step 16 of the heatexchanger. Further, there is achieved by using the second step 16 and having it amply dimensioned that the air discharged therefrom has a low temperature, in practice often 16°C or lower, and a considerable volume flow, in practice often 1000 m^3/h. It is realized that such a big flow of air having such a low temperature will have a considerably cooling effect on the dishes passing through the flow. Further, this flow of air will cool to a plesant temperature the ambient air at least at the exit of the machine.

In order to guarantee the intended temperature of 85°C of the water supplied to the nozzles 11 there is provided preferably in the line feeding the nozzles a temperature regulator governing the power of the heating device 22. Further there is provided in the vicinity of the outlet 20 a second temperature regulator the purpose of which is to start the spraying of heated water from the nozzles 3 as soon

as the temperature reaches a too high value irrespectively whether dishes are conveyed through the machine or not. Further, the fan 14 is operated until the temperature has been decreased to a suitable value which means that surplus heat, eg. during short interruptions of operation, is divented from the machine by operating the pre-spraying from the nozzles 3 so that there is prevented that heated and humid air inside the machine may leak out and increase to an unplesant value the roomtemperature where the machine is located.

The invention can be modified within the scope of the appended claims. Thus, it is possible to design the air exhaust device 17 in a manner different from that shown on the drawing. This device can, e.g. be designed as a tunnel having inside it a violent air circulation and through which the dishes has to be conveyed. Further it is possible to divert from the second step 16 of the heatexchanger a certain portion of the cool air and direct it to such working locations at the machine where the temperature is unplesant high.

CLAIMS

1. Method for saving energy and improving the working environment at least at the exit end of a commercial dishwashing machine through which dishes are conveyed, sprayed with one or more liquids and then dried in a heated drying zone characterized in that heated and humid air is withdrawn from the interior of the machine and/or the drying value below room temperature the energy of said air being transferred to the liquid and the air so refrigerated being exhausted in the vicinity of the dishes leaving the machine.

2. Method of claim 1 comprising the steps of spraying at different levels of temperature and using water for refrigerating the air characterized in that the water is heated a certain portion thereof being used for spraying at one of the lower levels of temperature while the remaining portion being heated to a higher level of temperature and being used for spraying at one of the higher levels of temperature.

3. Apparatus for carrying the method of claim 1 into effect the apparatus comprising a conveyor along which spray devices are provided and a drying compartment through which the conveyor extends characterized by at least one suction device at a location along the conveyor where high values temperature and humidity exist the suction device having flow connection with a heatexchanger having one inlet for cold water and at least one outlet for heated water the air outlet of the heat exchanger being designed for directing refrigerated air for cooling the exit end portion of the conveyor and the dishes carried thereby.

4. Apparatus of claim 3 and comprising along the conveyor a number of spraying devices provided for spraying at different levels of temperature characterized in that the heat exchanger has a low temperature water outlet connected to a spraying device for spraying at a low level of temperature, and a high temperature water outlet connected to a spraying device for spraying at a higher level of temperature.

5. A method of washing dishes substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

6. A dishwashing apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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TITLE: Dishwasher with conveyor passing sprays and drying zone has suction device attached to heat exchanger with cold water inlet and hot water outlet

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PATENT-ASSIGNEE: WEXIOEDISK AB[WEXIN]

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ABSTRACTED-PUB-NO: DE 2934699 A

BASIC-ABSTRACT:

The dish-washer incorporates a conveyor along which are positioned sprays and a drying zone. At least one suction section has a high temp. and humidity. The suction device is attached to a heat exchanger which has an inlet for cold water and at least one outlet for the heated water. Cold air is conveyed through an air outlet of the heat exchanger, for cooling the crockery at the exit of the conveyor.

The heat exchanger has a water outlet for low temp. and is connected to a spray. The heat exchanger has an outlet for hotter water, also connected to a spray.

TITLE-TERMS: DISHWASHER CONVEYOR PASS SPRAY DRY ZONE SUCTION DEVICE ATTACH HEAT EXCHANGE COLD WATER INLET HOT OUTLET

DERWENT-CLASS: P28